Energy, Mobility and Environmental Sectors in Barcelona

Ajuntament de Barcelona

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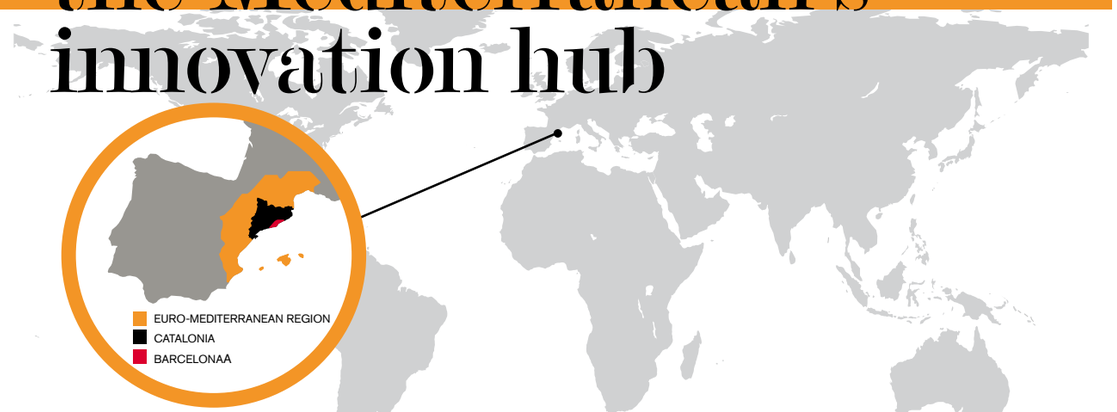
Barcelona, the Mediterranean's innovation hub



Barcelona, located in north-eastern Spain and on the shores of the Mediterranean, is one of the principal European cities and the centre of a vast metropolitan region of more than 160 towns, and with a population of more than 4.8 million people. It is the economic, cultural and administrative capital of Catalonia and the centre of an emerging area of economic activity in Southern Europe, with 17 million people and 800,000 businesses. The Euro-Mediterranean region, including the Balearic Islands, Valencia, Aragon and the south-east of France, is positioning itself in new strategic and internationally-competitive sectors, consolidating itself internationally as a major European metropolis.

With a long industrial tradition and a dense business fabric, Barcelona has a **highly diversified economic structure**. Its more traditional sectors coexist with new emerging ones, creating new clusters of knowledge that prioritise specialisation and competitiveness, focusing on internationalisation and creating a dynamic and innovative city economy. This has helped to drive Barcelona's strategic leadership in these fields.

In 2011, Catalonia was home to more than 5,000 international companies and it received 135 foreign investment projects, 85% of which were located in and around Barcelona.

Taking into account the distribution of gross value added across business activities, Catalonia is Spain's top autonomous region in the industrial sector, accounting for 23.6% of the total market. In terms of services, it is positioned second regarding national gross value added generated.

Additionally, Barcelona's entrepreneurial activity rate in 2010 was 5.5%, above both the Spanish and European averages according to the Global Entrepreneurship Monitor (GEM) 2010.

Barcelona's international economic activities are mainly driven by the Trade Fair, the Port, Airport, the Zona Franca Consortium, Barcelona's Tourism Consortium, Barcelona City Council and its new technological innovation districts.

Barcelona and Catalonia are leading Spain's movement towards a knowledge economy. As such, Catalonia accounts for 21.6% of Spain's innovation-based companies and 22.5% of all Spanish spending on innovation activities. Regarding this last point, and given the importance of innovation in generating competitiveness, productivity and the internationalization of companies, the energy sector is one of Barcelona's and Catalonia's key sectors.

Barcelona and its metropolitan area are home to the headquarters of the biggest companies in the energy and renewable energy sectors in Spain. In fact, the city has become one of the benchmarks in this sector in Spain, with examples that range from the 22@ Barcelona district, a technological innovation district par excellence, through to a wide business network of leading services companies, a deep-rooted entrepreneurial spirit, and a long tradition in both teaching and business in the energy sector.

Regarding the availability of an educated workforce, in recent years Barcelona has increased the amount of resources available both in terms of specialized education in areas related to this industry and also in terms of new technology and infrastructure available for research. The city boasts prestigious universities, research centres and highly-skilled R&D labs, and intermediary institutions that help the development of technology-based projects that are driving new initiatives via knowledge transfer.

02

10 reasons to invest in Barcelona

Barcelona offers a number of different elements that make it an attractive place to live, work and do business. Today the city is a highly interesting location for new economic activities. Some good reasons to invest here are as follows

01. Strategic geographic location

Two hours by road from France and one day from the main European cities. The gateway to Southern Europe and capital of the Union for the Mediterranean, Barcelona's port, airport, logistics parks, international trade fairs and city center are found within a five-kilometer radius.

02. Comprehensive transport infrastructure

Network of motorways connected to Europe, the fastest growing European airport; Spain's top port connected to the European railway network on international gauge track, Europe and the Mediterranean's top international cruise port, placed 4th in the world ranking; extensive metro, railway and bus network, high-speed train that will connect the city with the European network in 2013.

03. Center of a large, dynamic and diverse economic area

The Barcelona area has nearly 5 million inhabitants. It is the capital of Catalonia, with 7.5 million inhabitants, and the center of the Mediterranean Basin, an economic area with 18 million inhabitants. It accounts for 70% of Catalonia's GDP, and is the 6th largest urban area in Europe and has the 5th highest concentration in Europe in terms of industry. Catalonia has nearly 7,000 businesses working in innovation related activities, most of which are located in Barcelona and its surrounding area.

04. Successful foreign investment

Barcelona is ranked the 6th best city in Europe for business*, and Catalonia accounts for approximately 36% of all foreign investment in Spain and is home to more than 5,000 foreign companies, most of which are located in the Barcelona area.

05. Internationally renowned positioning

Barcelona tops a number of international rankings, which rate its urban environment, ability to attract foreign capital, entrepreneurial spirit and quality of life very highly.

06. Human resources prepared for the future

Barcelona has one of the leading labour markets in Europe in terms of critical mass in high value-added sectors; highly productive, one of the best in Europe according to the OECD; 8 public and private universities; a number of prestigious business schools including ESADE, IESE and EADA; 34 international schools; wide-spread use of new technology and a natural tendency for innovation and creativity.

07. Excellent quality of life

For the 14th year running, Barcelona boasts Europe's best quality of life for employees*. It has a mild climate, sun, beaches, culture, splendid leisure time and arts programmes, a network of 4,500 educational institutions, modern and accessible health system. It is easy to get around on the public transport system and boasts beautiful parks that surround the city.

08. Large-scale urban-planning projects for the future

A complete and renewed offer in terms of intelligent land for the development of new economic projects in the main sectors of the knowledge economy, which is transforming more than 1,000 ha and 7 million m^2 of build surface space in Barcelona's metropolitan area.

09. Competitive real estate market

Wide range of offices, retail spaces and industrial warehouses with excellent price/quality balance and a high occupation rate.

10. Unique public/private cooperation

Barcelona City Council and the Catalan Government are highly committed to companies. The success of traditional public/private collaboration has been key to Barcelona's transformation.

*According to Cushman & Wakefield, European Cities Monitor 2011.

03

The energy, mobility and environmental sectors in Barcelona and Catalonia

The energy sector is vital for the economy and welfare of society, as much because of the importance of the industry itself, but especially because of its strategic value; energy is an essential element in any industry, service and transportation system. For Barcelona and Catalonia, in general, energy is an essential factor in competitiveness and economic development.

Thanks to its industrial and entrepreneurial culture, Catalonia has gathered tremendous energy-sector know-how, developing a large number of R&D programmes and projects in the area of renewable energies, air conditioning, natural and cooling technologies, instrumentation and electricity control.

Energy

The Energy Plan 2006-2015, developed by the Catalan government through the Catalan Energy Institute (ICAEN), has made a commitment to position itself at the top of the European energy sector in the 21st century. The Plan will develop a diversification strategy regarding energy sources by promoting renewable energy, improving efficiency and energy saving, creating the energy infrastructure necessary to support research and development, and technological innovation in this field.

In 2002, Barcelona started its **Energy Improvement Plan (PMEB),** which became the first structured approach to the sector in the city of Barcelona. In 2011, the City Council approved a new plan called the **Barcelona Energy, Climate Change and Air Quality Plan 2011 - 2020 (PECQ).** This plan brings continuity to previous strategies in terms of global strategic planning in the energy and climate change sectors, but also incorporating air quality issues from the local perspective. Barcelona's Energy Agency is responsible for developing PECQ.

Electric mobility

One of the sectors involved in the energy plan, which has a big impact on the environment, is the mobility sector. Electrical mobility can help reduce $C0_2$ emissions, reduce energy dependency and improve efficiency; its growth helps to develop a more sustainable economy based on innovation and research.

Given the general context of research and development, cities are emerging as potential test banks to spread the use of these technologies to citizens and to create key environments for new and growing industries in the electric mobility sector. Nearly 30% of the automobile industry in Spain is concentrated around the metropolitan area of Barcelona, which is one of Europe's main centres for the sector. Supporting the development of electric mobility is vital for the global competitiveness of the automotive sector, but also to improve the environment and quality of life in our city. The introduction of electric vehicles and the implementation of associated infrastructure is a first step towards environmental sustainability and improving air quality, but not enough.

Environmental and Waste Management

In the field of waste management, Barcelona, and Catalonia as a whole, boasts a cluster-like grouping of public authorities, companies, universities and socio-economic stakeholders and experienced experts, a benchmark for similar areas in Latin America, the southern Mediterranean and the Middle East.

The operational management model of municipal solid waste (SW) in Catalonia integrates the hierarchy of different waste management options available in the EU, and through a process of gradual improvement, these are applied to niche SW areas for optimal results.

In particular, Catalonia has some of the most advanced mechanical biological treatment plants in the European Union, which have been copied in countries like France or the UK. The treatment of organic matter is also a characteristic feature of the Catalan management model, making it a benchmark for countries with a Mediterranean climate.

So, Barcelona and Catalonia have the tools to successfully face future challenges and become a worldwide leader in the energy sector in the coming years:

- **Firm commitment of governments** to create a model of sustainable development through the promotion of renewable energy, encouraging energy-saving efficiencies and investment in infrastructure that balance the assumption of growth in demand and sustainability.

- **Leading international entrepreneurial culture** specialized in different market segments: supply, distribution and commercialization of energy, technology, design and manufacturing renewable energy facilities, and an industrial sector that produces capital goods for the energy business.

- **A culture of research and technological innovation** enhanced by the creation of the so-called Energy Park and the European Fusion Agency's ITER Project, which will position Barcelona and Catalonia as an international player in innovation and technology in the energy sector.

10 reasons to invest in the energy, mobility and environmental sectors in Barcelona and Catalonia:

01 Barcelona: towards a new city model with sustainability and energy-saving efficiencies

02 Commitment to renewable energies

03 Major operators in Catalonia

04 Large city infrastructures

05 Barcelona LIVE Platform: a benchmark in electric mobility

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10 reasons to invest in the energy, mobility and environmental sectors in Barcelona and Catalonia

01.
BARCELONA: TOWARDS A NEW CITY MODEL WITH SUSTAINABILITY AND ENERGY-SAVING EFFICIENCIES

Barcelona is positioned as one of the major European capitals in the energy sector. The city's energy sector has a large number of businesses, and attracts investments from around the world as part of its objectives for the coming decades. Barcelona has developed a plan with the aim of increasing its commitments to the energy sector.

The **Barcelona Energy, Climate Change and Air Quality Plan 2011 - 2020 (PECQ)** involves a programme of local action plans aimed at achieving a more sustainable city model. It includes 108 projects, chosen because of their value in terms of energy use, local and global greenhouse gases, and an economic perspective, which provide different levels of the action plan, including local bye-laws, grants for facilities, training programs and performance initiatives regarding mobility to improve the city's air quality. Barcelona's Local Energy Agency Consortium manages this PECQ.

Barcelona's Local Energy Agency Consortium consists of those authorities directly involved in energy and environmental management regarding the scope of action, and whose mission is to promote and position Barcelona as an example of how to deal with issues related to energy and environmental impact. Its aim is to help the city achieve, through consensus and participation, optimum levels in the use and management of local energy resources, and promoting sustainable, rational and quality energy demand.

This should allow Barcelona to comply with the environmental and energy commitments acquired at the local level (specified in the Energy Plan and Agenda 21) and internationally (the result of the Johannesburg, Kyoto, Aalborg and Rio de Janeiro summits).

The work the Agency carries out is aimed at the sustainable development of the city by promoting energy conservation, energy efficiency and the use and knowledge of renewable energy and optimizing the quality of services related to this sector and improving air quality.

The main objectives of the Agency are:

1. Ensure the implementation of the Barcelona Energy, Climate Change and Air Quality Plan (PECQ), with a time frame of 2020 set for the new energy scenario and air quality.

2. Encourage energy saving and energy efficiencies.

3. Promote the use of local renewable energy sources.

4. Make progress on improving the quality of energy services.

02.
COMMITMENT TO RENEWABLE ENERGIES

Renewable energy sources are a priority for Catalonia to be positioned as one of the main hubs worldwide in this sector.

Barcelona and Catalonia are committed to renewable energy

Energy Plan 2006-2015 sets goals that go beyond the objectives set by the EU. It is expected that the percentage share of renewables in the primary energy balance in Catalonia will go from 2.9% in 2003 to 9.5% in 2015. Therefore, not only does it comply with the European objective of doubling its percentage, but it is expected to be multiplied by 3.3. Regarding **electricity power generation,** it is expected that the percentage of renewable energy will reach a value of 24% in 2015.

Within the group of renewable energies it is noteworthy the biofuels and the wind power:

- **Biofuels** are in the approach phase to market introduction; it is the renewable energy that has the highest energy potential in the short and medium term. It is expected to represent 28.6% of renewable energy consumption in Catalonia, thanks mainly to biodiesel with a consumption of 870,000 tonnes, and it is expected to replace 18% of automotive diesel consumption.

- **Wind power** is one source that presents greater possibilities, since its associated technology is being developed to full potential, once it has passed the stages of R & D and market penetration. Therefore, reaching the highest wind potential available to Catalonia is one of the priority energy policies for years to come. It is expected that the installed capacity in wind farms in Catalonia will increase significantly, given the potential already identified in various studies and initiatives. Forecasts show wind power installations could reach 3,500 MW, with 25.7% of renewable energy consumption from wind-based technologies.

As regards the other renewable energies, we can highlight:

- **Hydroelectric power:** this is becoming a major energy source contributing 17.9% to renewable energy consumption in Catalonia.

- **Biomass:** strategies are concentrating on promotion, identification and development of biomass energy generation plants, overall biomass and biogas production will contribute around 512.1 ktoe to energy accounts in 2015, which represents 17.4% of total renewable energy.

- **Solar thermal:** the goal is to reach 1,250,000 m^2 of collectors.

- **Solar photovoltaic energy:** With a target of 100 MW, this energy technology is still being fully developed. Regards the importance of this energy source in the future, it is considered essential to continue supporting its development.

To promote these renewable energy objectives, the Autonomous Government of Catalonia, through the **Catalan Institute of Energy,** manages several renewable energy installation grants in Catalonia. **Barcelona's Housing Consortium** also provides grants for the installation of renewable energy in city buildings.

03. MAJOR OPERATORS IN CATALONIA

Catalonia has been a pioneer in the creation of companies that are committed to developing the renewable energy sector. Some of the most illustrative ones are:

Alstom, world leader in infrastructure for the generation and transmission of electricity and rail transport, and a leader in innovative and environmentally-friendly technologies. Some of its main activities include the construction of the world's fastest trains and highest-capacity automated metro, providing integrated turnkey solutions for power stations and associated services for a variety of energy sources including hydropower, nuclear power, gas, coal and wind.

Alstom Wind, based in Barcelona, has been working in the renewable energy sector since its start in 1981, designing, manufacturing and building "turnkey" wind farms. Integrated in the Alstom group since 2007, it develops latest-generation, on-shore and off-shore wind turbines, and has installed more than 2,100 in 114 wind parks in Spain, Portugal, France, Italy, India, Japan, UK, Brazil and the United States.

Fersa Energia Renovables, the first independent company trading on the Spanish stock market and the first in Europe dedicated to the development of clean energy. Its main objective is the generation of electricity using 100% renewable sources like wind, solar or biomass. In 2006 it began its international expansion with the dual aim of diversifying its business geographically and doing more profitable business projects outside Spain. It is present in nine countries with an installed capacity of 165.1 MW diversified across four countries and with a portfolio of 1,000 MW under construction and authorized parks.

Cespa, Comsa Emte Medio Ambiente, FCC Medio Ambiente, GBI Serveis, Griñó Ecològic, Grup Hera, Ros Roca, Urbaser and Valoriza Servicios Ambientales are companies in the field of waste management, all leading European players with a strong international presence and world leaders in certain niche markets (mechanical biological treatment, equipment for refuse collection, etc..). They have a market share of 70% in the waste management sector in Spain, and together turn over more than 3,000 million per year.

SENDECO$_2$, the European Carbon Dioxide Emission Trading (EUAs) and Carbon Credits scheme (CERs) is specialized in SMEs. It is a secondary market created in 2004 and designed by a team of professionals with extensive experience and expertise in capital markets and derivatives. Its electronic platform for trading over the Internet, it is the perfect link for SMEs and large companies wanting to access the market directly.

Agbar, the leading operator in the integrated water cycle in Spain and one of the world's most important players, present in nine countries. Not only is it dedicated to managing water, but it also has a special emphasis on managing and generating knowledge about the integral cycle to make it more efficient and sustainable. One example is the creation of the Water Technology Centre, based in Cornellà de Llobregat (Barcelona).

Gas Natural Fenosa, this market leading gas and electricity operator in Spain and Latin America is one of the largest operators of combined cycle plants in the world, based in Barcelona. In the power generation business, the Group's strategy is based on having a balanced generation mix that is competitive and environmentally friendly, in line with the objectives included in the fulfilment of the Kyoto Protocol.

The field of electro-mobility is an opportunity for energy companies to expand their business lines, while it is also an opportunity for companies from outside the energy sector to diversify their activities. The following table shows the major existing activities in the field of electro-mobility.

MAIN OPERATORS IN THE ENERGY SECTOR IN CATALONIA

GAS NATURAL FENOSA, one of the leading multinational companies in the gas and electricity sector. Present in 25 countries, it has nearly 20 million customers and an electric power potential installed for supplying a capacity of 17.3 gigawats. Following the acquisition of the electricity company Unión Fenosa, it became the largest integrated gas and electricity company in Spain and Latin America. With a fleet of 10 tankers, it is one of the largest operators in liquefied natural gas (LNG) in the Mediterranean and Atlantic coast, which operates 30 bcm.

ENDESA, one of the top Spanish electricity companies and the leading private supplier in Latin America. It is the top distributor and trader of energy in Catalonia.

IBERDROLA, also has a presence in Catalonia; it is one of the top energy companies in the world and occupies a world leading position in wind production.

REPSOL, one of the ten largest oil companies in the world, and the largest private energy company in Latin America in terms of assets. In Catalonia, it has large biofuel plants construction projects.

RED ELÉCTRICA, owns the electricity transmission network in Spain, with assets and offices in Catalonia.

PRYSMIAN, world leader in the manufacture of electrical and communications conductors, with its headquarters in Catalonia.

ELECTRO-MOBILITY COMPANIES

Energy distributors

ENDESA
www.endesa.com
GAS NATURAL
www.gasnatural.com
IBERDROLA
www.iberdrola.es

Components manufacturer

SIEMENS
www.siemens.com
CIRCUTOR
www.circutor.es
SCHNEIDER ELECTRIC
www.schneiderelectric.es
SIMON
www.simon.es
FICOSA
www.ficosa.com
T-SYSTEMS ITC IBERIA
www.t-systems.es
TELVENT
www.telvent.com
COBRA SISTEMAS
www.grupocobra.com
GRUPO ETRA
www.etra.es

OEM

SEAT
www.seat.es
VOLTA MOTORBIKES
www.volta-motorbikes.com

Recharging operators

MOBECPOINT
www.mobecpoint.com
REGESA
www.regesa.es
SABA
www.saba.es
B:SM
www.bsmsa.es

Municipal services

CESPA
www.cespa.es
CLD
www.corpcld.com
FCC
www.fcc.es
URBASER
www.urbaser.es
TMB
www.tmb.cat

Investigation Centres

APPLUS -IDIADA
www.idiada.es
CLUSTER MOTO
www.clustermotos.cat
QUIMERA
www.quimera-project.com
b_TEC
www.btec.org
BDIGITAL
www.bdigital.org
CEEC
www.clustereficiencia.org
CITCEA-CIDEM (UPC)
www.citcea.upc.edu
CETIB
www.cetib.cat
CTAE
www.ctae.org
CTM
www.ctm.com.es
IREC
www.irec.cat
LEITAT
www.leitat.org
UPC
www.upc.edu
STA
www.stauto.org

04.
LARGE CITY INFRASTRUCTURES

DISTRICLIMA's network map

Another priority area for Catalonia is the development of the necessary infrastructures to achieve the energy demand growth over the coming years, considering the political exploitation of renewable energy sources and energy saving and efficiency.

Generation Sources

Analysing infrastructure, the first item of interest is the source of power generation. In this case, Catalonia, connected to the national grid, has the most modern and sustainable energy sources in Europe:

- **Combined cycle groups:** the three nuclear groups currently operating in Catalonia are going through a process of gradual replacement based on conventional power stations. Among these, the most appropriate technology is fuelled with combined cycle natural gas, which has a low-environmental impact, because it is highly efficient. In Catalonia, there are currently eight groups using combined cycle, with a total capacity of 3,300 MW.

- **Wind farms:** forecasts show the installed capacity in wind farms in Catalonia will increase significantly in coming years to reach 3,500 MW.

- **Electricity power plants:** forecasts indicate that by 2015 the installed capacity in power plants, considering new infrastructures, will be the following:

Neighbourhood acclimatization networks in Barcelona

Barcelona's goal is to become a self-sufficient and sustainable city. One of the ways to achieve this goal is by actively developing centralized climatization systems using residual energy sources.

Centralized climatization systems provide buildings or shopping centres thermal energy in the form of hot and/or cold water for its climatization needs, and this energy is generated in a centralized production plant. The buildings being supplied are connected to the plant through a series of pipes that channel thermal fluids controlled and regulated from the central office. Two large district heating networks are currently being developed in Barcelona: covering the area of 22@ and the Forum (DISTRICLIMA) and the other, the Zona Franca free trade area and the district called Marina del Prat Vermell (ECOENERGIES).

DISTRICLIMA Network

In 2002, Barcelona decided to implement the first heating and cooling network in the Forum area, and it is currently being expanded to cover part of the energy needs expected in the 22@ district. This network uses steam from the residual energy in the energy revaluation plant in Besòs (TERSA), resulting in significant primary energy savings.

DISTRICLIMA was the first of its kind in Spain and was created in 2002; it is an urban heating and cooling network supplying heat, air conditioning, and clean, warm water, and it came on-line in 2004. The project was developed initially in an urban area that was being urbanized for an event called Barcelona Forum of Cultures 2004. In 2005 a second phase started, with an expansion to the network across the 22@ district. Today DISTRICLIMA is the largest urban network of Spain. Thanks to the highly-efficient nature of the system, Barcelona saves more than 50GWh in primary energy, which equates an annual saving of 10,000 tonnes of CO_2 emissions.

Network of Ecoenergies

The implementation of a new centralized climatization network in the district of La Marina really strengthens Barcelona's commitment to this technology, and the new development projects include connections to all suitable municipal buildings from the district heating network.

What makes the ECOENERGIES network unique is that the system will get its 'cold' from glycol waters cooled in the evaporation of ENAGAS (in a regasification process of Liquefied Natural Gas-LNG, which comes in tankers at -160°C and which is re-gassed to +15°C). In this process of heating the gas, the glycol water is cooled and this goes to a tank.

However, what makes the DISTRICLIMA network unique is that it uses steam generated during the recovery of RSU carried out by TERSA to generate hot and cold water (with absorption machines) for climatization.

The Zona Franca climatization network is the second DISTRICLIMA facility in Barcelona. This is particularly important because this type of network, well developed in certain European countries, has hardly been used in Southern Europe. In this field, **Barcelona has become a benchmark in southern Europe.**

Other infrastructures: Infrastructure for Electric Vehicle Recharging

As an example of infrastructure that is bringing innovative new business models in the field of energy services, and which is enabling a technological transformation of mobility, we can highlight the rollout of recharging points for electric vehicles, which Barcelona is developing under the umbrella of the so-called **LIVE Platform** (Logistics for the Implementation of the Electric Vehicle) *(see section 5).*

In 2011, Barcelona became one of the leading cities in Spain because of its development of a network of public recharging points for electric vehicles. The city now has almost 250 points in operation and next year aims to exceed 500. The goal is that every citizen can find a recharging point within five minutes of their house. Different public bodies and initiatives are participating in the deployment: Barcelona Energy Agency, the Movele project (IDAE) and grants from the Catalan Institute of Energy, and private companies (SEAT, SIEMENS, ENDESA). In parallel, large shopping malls such as El Corte Inglés and Servei Estació, eateries, including international chains, such as NH Hotels or infrastructure businesses like Tabasa, are installing recharging points themselves.

Barcelona's network is an open model with several providers implementing different technologies, which favours the emergence of entrepreneurs and provides opportunities for transformation into more established companies. The access points in public streets are managed by the City Council by way of a municipal control (Network Operation Centre), which checks user identification (ID card), and the interoperability of different systems, centralizing service incidents and monitoring all the charge points to handle any issues in real time. In addition, Barcelona has a wide range of underground public car parks, managed by companies like B:SM, SABA, REGESA or ESMAPARK, among others, that have lots of recharging points for electric vehicles.

However, in the future, most recharging will be done in private car parks and at night, which means cheaper prices for the user and ensures the use of renewable energy production peaks. The long-term strategy of development for the public network is focused on Barcelona's underground car, either public or concession operations, with reserved spots on the street for emergencies and for motorcycle recharging. Also expected to continue is the development of a network of recharging points in workplaces and private establishments in the hope that new state and regional laws allow and ensure the deployment of charging points in community buildings and private housing, in accordance with the facilities' safety regulations and ownership share coefficients, ensuring widespread recharging services for these vehicles.

Electricity companies such as Endesa, Iberdrola and Siemens are already investigating new ways of recharging and standards to widen the current supply. Schneider Electric, Circutor, Scame, Simon, Mobecpoint, Atomelec, Betterplace and Coloumbteach are some companies that are positioning themselves as suppliers of equipment for innovative automatic recharging stations. In Barcelona, they are carrying out pioneering projects, like the first state-sponsored speed recharging station by Endesa and Cepsa.

05.
BARCELONA LIVE PLATFORM: A BENCHMARK IN ELECTRIC MOBILITY

Map of the recharging points in the city, available at ***www.livebarcelona.cat***

The LIVE Platform provides a unified and general implementation strategy plan for electric vehicles, which aims to support industry, sustainable mobility and the environment covering all aspects along the electric mobility value chain. This is a public-private platform that promotes the use of electric vehicles in the city as an opportunity to position Barcelona as a centre of innovation in electric mobility worldwide.

LIVE Platform 2012 board members are: Barcelona City Council, ICAEN (Autonomous Government of Catalonia), IDEA (Ministry of Industry), BSM (Barcelona Municipal Services), SEAT, ENDESA and SIEMENS.

Its main functions are:

- Support the development and promotion of showcase projects in electric mobility (Living Labs), favouring the early deployment of electric vehicles and obtaining results and best practices.

- Providing the necessary tools and resources to create a network of innovative, economic and industry assets to promote R&D. Support the creation of local partnerships in national and European projects, and technology transfer and knowledge in university and professional fields.

- Promote the organization and hosting of events and activities that promote electric mobility in Barcelona.

- Promote the development of public and private re-charging networks across the Metropolitan Area of Barcelona.

- Become a reference point for citizens, businesses and citizens in Barcelona for any aspect of electrical mobility, through the creation of the first European technical and public information office for citizens for the deployment of electric mobility.

Since its beginnings until 2012, under the **LIVE Platform (Logistics for the Implementation of the Electric Vehicle),** various programmes have been carried out primarily aimed at promoting the importance of sustainable mobility and electric vehicles and its possible new market opportunities, addressed mainly to industrial sectors, but also to the general public:

- Creation of the 1st technical and public information office.

- Participation in events such as the Summer Sessions b_TEC; Ministerial Mission to Japan; LIVE presentation at EVS 26 in Los Angeles with the hand-over to EVS27, which will be held in Barcelona in 2013, participation in the EV Battery Forum 4th Edition; participation in the Ministerial Mission to China and the Shanghai Motorshow as members of the International Electric Vehicle Pilot City and Industry Development Forum. Participation in the organization of Expoelèctric, ECPSèries; Presence in international fairs such as the International Motor Show, ExpoCarbon, Smart City Expo and World Congress, Intertraffic, where experts in the LIVE platform made technical and promotional presentations.

- Participation and promotion of educational initiatives such as the first post-graduate specialized course in electric vehicles delivered from October 2011 at the UPC, or the future creation of a showroom designed to educate, inform and generally get citizens, students and children involved.

- Promotion of pilot projects and development of new business models in the area of electro-mobility to boost entrepreneurship and the transformation of industrial land: Honda EV-Neo, E-SEAT Fleet, MOTIT (Sharing 2.0), and MobecHotels MobecCampus, Chimera Project, Tour Motorbikes, Chargelocator, among others.

- Promotion of the electrification of public transport in the city –the bus fleet (TMB) and taxi sector–, as well as the promotion of car sharing that promotes the deployment of electric vehicles and their use in the daily lives of citizens and tourism.

All these different promotional programmes are being carried out under the guidelines and criteria set out for urban mobility in the **Urban Mobility Plan,** which defines Barcelona's mobility based on public transport, intermodal systems -adapted and collective-, which favours mobility on foot and by bicycle.

To ensure the successful introduction of this new technology, it is essential that there is collaboration between the different research centres and universities to develop new technologies and business models along the whole electro-mobility value chain. Some schools and universities involved in electro-mobility in Catalonia are: Applus-Idiada, ASCAMM, Bdigital, b_TEC, CEEC, CTAE, CTM, Creafutur, IREC, Leitat, UB, UPC or STA, amongst others.

In 2013, Barcelona will hold the 27th edition of the EVS Electric Vehicle Symposium, a benchmark in the world of sustainable mobility. This congress is held every year on a different continent.

06.
ENERGY PARK, A STRATEGIC PROJECT FOR THE FUTURE OF THE SECTOR

b_TEC Foundation is the promoter behind the Diagonal Besòs Energy Park Campus. When finished, it will have a total area of about 25,000 m² and is designed to bring together educational centres, R&D&i centres and companies in the energy sector to generate a continuous interaction between these three stakeholders in a framework of excellence.

Barcelona is leading the urban and economic transformation of the Besòs area, with the creation of a know-how centre of excellence: the Diagonal Besòs Campus. This project is led by the Barcelona Technological Innovation Foundation (b_TEC) and its overseeing body (Diagonal Besòs Campus Consortium - made up of local authorities led by the Cities of Barcelona and Sant Adrià, the Polytechnic University of Catalonia and the University of Barcelona) and other institutions such as the Autonomous Regional Government of Catalonia and Barcelona's Chamber of Commerce.

Diagonal Besòs Campus will focus its know-how on sectors related to energy, water, transport, and production technology and mechatronics, but the most important project is the Energy Park (EP).

The Energy Park, located between the cities of Barcelona and Sant Adria del Besòs, next to 22@Barcelona -the city's new business and innovation area- is designed to promote innovation and economic activity, activities that promote research from Campus members, laboratories and companies, and ensures coordination of all parts of the park.

The Energy Park will form a cluster that collects, integrates and coordinates knowledge and innovation taking place in Catalonia and Spain, whilst also looking for best-of-class international experiences.

Its main objective and chief assets are:

- **In terms of research:** Acting as a hub for technological and market knowledge in the energy field, strengthening R&D infrastructure in this sector, acting as a node for participation in technology platforms and European Union programmes and promoting assessment and certification services in the Park's knowledge areas.

- Some assets that particularly stand out include the I**nstitute of Energy Research of Catalonia (IREC),** set up in 2008 and based at the Energy Park; it develops cutting-edge R&D in the energy sector. The ITER project and the European Agency Fusion for Energy, founded in 2007 and also based at the Energy Park, is mainly responsible for supporting scientific and technological research for building components related to the ITER project and establishing contracts with European industry for the manufacture of these components.

- **In terms of companies:** Improve business competitiveness in the sector and encourage innovative companies from the sector to set up in Park, and create a business incubator specialized in the energy sector.

- Another highlight is the **Catalonian Energy Efficiency Business Cluster (CEEC),** an active business cluster with almost one hundred participating companies, created to improve the competitiveness of companies in the Energy Park by participating in technology projects and the transfer of research results.

- Finally, another objective is to ensure an ecosystem of institutions and coordinators coming from the sector, that will develop a collaboration strategy with the Public Administration. In this case, b_TEC, as the entity behind the promotion and coordination of the Energy Park, is a key element.

New challenges facing Barcelona in this field are the development of the so-called **Water Park** as a space for research, innovation and knowledge sharing, dealing with the economics and technology of water management, and secondly, the **Mobility Park,** a space for the development of knowledge dealing with sustainable mobility.

07.
ITER PROJECT IN BARCELONA

Barcelona is on the international energy map and hosts the European Fusion Agency, Fusion for Energy, responsible for supporting scientific and technological research for the construction of ITER components and establishing contracts with the wider European industry to manufacture components.

ITER (the meaning in Latin is 'the way') is an international collaboration project for developing nuclear fusion and its final objective is the building of a large experimental fusion reactor in the centre of Cadarache (France). Barcelona is playing host to the European Fusion Agency (F4E), a body set up to control all the project's construction contracts and business relations, and the development, operation and decommissioning of the project, with a total budget of more than 5,000 million euros.

The ITER reactor mission is to demonstrate the scientific and technological feasibility of fusion energy as a renewable energy source that is clean and inexpensive. This experiment is carrying out research required to build demonstration units that will be the direct precedent for the first industrial unit for electricity production.

F4E's location in this facility makes the Energy Park into a key stakeholder in the international energy sector.

F4E is an educational and research leader in this area, with more than 300 technical experts in the fusion area, plus others in related disciplines that takes the total to somewhere around 450. But the presence of F4E in Barcelona represents a great opportunity for business in the city because its proximity is a clear incentive for businesses in Catalonia and Spain to participate in the project. As such, Barcelona City Council, through the b_TEC Foundation, helps organize and facilitate the participation of companies from the city in the project, ensuring the integration of knowledge generated at Fusion for Energy in the city.

08.
THE ENVIRONMENTAL FORUM PLATFORM

The Environmental Forum Foundation (FFA) provides a space for debate and reflection for companies in the environmental sector, bringing together interested stakeholders, besides the development and promotion of local economic activities related to environmental issues in Barcelona and Catalonia.

In recent years, FFA has promoted a number of public-private collaboration initiatives to share information and evaluations between companies and public administrations, to ensure that environmental management is advancing towards effective implementation of more sustainable solutions, in order to reach a consensus diagnosis, highlight challenges, and agree on policies to manage them, and create opinion in society.

FFA activities include:

- **The creation of the Centre for Innovation and Technology of Municipal Solid Waste (CITREM)**, in order to meet the technological and organizational challenges of Catalonia's Municipal Solid Waste sector.

- The work of a **Think Tank on waste and climate change,** with the participation of the **Solid Waste Agency of Catalonia,** with the understanding that improvements to move towards more sustainable waste management represent a significant improvement in emissions of greenhouse gases, and a positive energy balance, and in order to influence public policy regarding the control of climate change, energy and sustainability.

- The group's **R&D Waste** unit, a FFA initiative that helps create a process of dialogue between public authorities, waste management companies and innovation centres on the trends in R&D&i in the Catalan municipal waste sector, with the aim of carrying out more and better research in Catalonia.

- Completion of 'Study on the economic sector of the environmental sector in Catalonia,' a biennial study, now in its seventh edition, which has become a reference for the industry, and features all the key data on industry size, trends, mid-term prospects; it also sets out future challenges and opportunities.

- In the area of managing change and the economics of climate change, FFA is a key stakeholder that has been working for years with the objective of spreading knowledge and promoting initiatives to develop carbon markets. Initiatives like the launch of SEN-DECO$_2$, the organization of conferences under the brand ExpoCO$_2$, or work done by the FFA to host Carbon Expo Barcelona, show some of the results of this commitment

- The **ITER project,** led by the FFA and with the participation of all regional governments and the Ministry of Environmental and Rural and Marine Affairs, has brought about a unified system and language so transport companies and management can comply with statements about hazardous waste using a single on-line procedure working within an autonomous community, between communities and across the whole of Spain.

- The FFA organizes a yearly event called the Sustainable City Awards, with Barcelona's Trade Fair, recognizing the efforts of those municipalities or local authorities that have undertaken innovative, sustainable development initiatives, or started plans for medium-term action towards sustainability.

Barcelona also excels in the field of change management and the economics of climate change, thanks to **SENDECO$_2$,** the emissions trading reference market in Spain, Italy and Portugal, especially in the SMEs market, and the trade fair **Carbon Expo,** which has already been held in Barcelona on two occasions. Both initiatives were launched by the FFA.

Institute of Energy Research of Catalonia (IREC) headquarters

09.
CULTURE OF RESEARCH AND DEVELOPMENT

In recent years, Catalonia has seen a progressive increase in R&D&i technology in the energy sector. This increase is gradually placing Catalonia at the same levels of research and technological innovation as the most advanced countries developing R&D.

Catalonia has a strong network of support for research and technology transfer and its government is clearly committed to research and development. In fact, Catalonia is Spain's most important scientific lab and the leading city in the Mediterranean. In 2009, some 3,284 million euros were invested in R&D, 1.68% of GDP. Its R&D production represents almost a quarter of the total in Spain, and nearly 1% of the world's R&D production, similar to countries such as Finland and Scotland. Barcelona's strategic commitment to develop a knowledge-based economy has meant that the city is 15th in the world ranking of scientific production and 6th in Europe.

Catalonia has an extensive network of research support and technology transfer facilities, comprising:

- **Network TECNIO:** Includes more than 100 stakeholders and 3,000 researchers, its turnover was over EUR 146 million and 10 new spin-offs were created in 2009.

- **Network CERCA:** Includes 39 centres of excellence dedicated to research in Catalonia. In 2009, its turnover was 187.5 million euros with the support of more than 2,750 researchers.

- **Network of Science and Technology Parks (XPCAT):** Brings together large production facilities for transferring, promoting and making use of knowledge; it is the contact point between the communities involved in research and innovation.

In the energy field, the Autonomous Regional Government is developing the following: Energy Plan with the aim of boosting research and technological developments in the energy field. Some examples of existing research centres based in Catalonia that play an important role in R&D in the energy sector are:

- **Institute of Energy Research of Catalonia (IREC)**: Was established in 2008 with the goal of becoming a centre of excellence in the field of energy efficiency.

The Institute works on four complementary technologies: electrical networks, capture and confinement and uses of CO_2, bioenergy and offshore wind, with transversal areas including advanced materials for energy, electricity and power electronics, and socio-technical research. IREC's mission is to help increase the competitiveness of industry through research and technological development.

- **Reference Centre for Advanced Materials for Energy (CeRMAE):** Consists of seven research groups and has priority research areas in new materials, methods and processes for the production of energy, materials for storage and transport of energy, materials for the rational use of energy, and materials for safety, efficiency and emissions reductions in energy use.

- **Centre for Technological Innovation in Static Converters and Actuators (CITCEA):** It is a research a research, development and technology transfer facility which aims to transfer innovation to industry and provide solutions to new technology needs required by the market, especially SMEs. CITCEA's activity is divided into three areas: mechatronics, energy and education.

Finally, regarding the field of research and development in electro-mobility, collaboration between different research centres and universities to develop new technologies and business models along the value chain is essential to ensure the successful introduction of this new technology. Some schools and universities involved in electro-mobility in the country are: Applus-Idiada, ASCAMM, Bdigital, b_TEC, CEEC, CTAE, CTM, Creafutur, IREC, Leitat, UB, UPC, and STA, among others.

10.
URBAN ECOLOGY, A KEY FACTOR IN 'BARCELONA SMART CITY'

The concentration of population in cities brings new political, economic and social challenges that will mark much of the global agenda in the coming years. In addition, the criteria applied in the conception, design, planning and building of cities determine the energy efficiency of urban systems. Given this background, one of the most important challenges facing cities across the world, and Barcelona too, is the progress toward self-sufficient cities with low energy emission levels.

Barcelona has been leader in taking the role of local energy planning in order to improve energy efficiency, combat climate change, local pollution and promote renewable energies across the urban territory. As such, since the year 2000, Barcelona is carrying out all its energy plans within a detailed energy planning framework, with noteworthy initiatives, including:

- The Mayors Agreement (signed by Barcelona) was established in 2008 and promotes the development of local energy plans to combat climate change and reduce emissions by 20%, confirming the importance of the local level as an essential element of energy planning.
- Solar Thermal Bye-Law (1999) requires solar panels on all new buildings, with nearly 70,000 m^2 installed to date, making Barcelona a pioneer with this initiative.
- DISTRICLIMA and Ecoenergies, this made Barcelona the first city in southern Europe to develop distribution networks that used cold and hot water heating for whole neighbourhoods with energy-saving efficiencies by taking advantage of energy sources like biomass waste from parks and gardens, municipal solid waste that the city generates, whilst the cold comes from a process derived from regasification of liquefied natural gas that arrives in LNG carriers at the city's port.
- Sustainable Leadership with the Live Platform.

So, Barcelona is already setting benchmarks and has numerous 'intelligent' assets in areas like energy, transport, urban planning or the use of ICTs, but this is a vibrant city that is continuously moving with the times, and now it has a key role in the future of cities.

The City wants to make Barcelona a world reference in the Smart City network, promoting a new approach to cities, bringing planning, ecology and information technology together to take technology to all city districts to improve citizens' quality of life.

Specifically in the energy sector, Barcelona is concentrating its efforts on reducing the energy consumption of its buildings, by planning out the whole territory under the concepts of saving and self-sufficiency. Self-sufficient blocks of buildings will be planned and there will be new campaigns to refurbish buildings under energy guidelines. So, Barcelona continues to open new channels in the area of innovation and urban ecology to become a benchmark smart city, also in the field of self-sufficiency.

Another asset Barcelona has regarding the Smart Cities programme is its great expertise in organizing avant-garde technology events. Barcelona is second in the ICCA (International Congress & Convention Association) standings for being an ideal city to host conferences and professional meetings. A clear example of this Barcelona leadership is the creation of the Smart City Expo & World Congress, the first international Smart Cities exhibition held in Catalonia, as part of Barcelona's bid to consolidate its position as a Smart City and benchmark. Its objective: to show technology that can be used by cities to make them more sustainable and efficient and to improve citizen quality of life.

05

Links

Education centres

Barcelona GSE: Graduate School of Economics
www. Barcelonagse.eu

EADA- Higher School in Management and Administration
www.eada.edu

ESADE Business School
www.esade.edu

IESE Business School
www.iese.edu

UAB (Autonomous University of Barcelona)
www.uab.cat

UB (University of Barcelona)
www.ub.es

UIC (International University of Catalonia)
www.unica.edu

UOC (Open University of Catalonia)
www.uoc.edu

UPC (Polytechnic University of Catalonia)
www.upc.es

UPF (Pompeu Fabra University)
www.upf.es

URL (Ramon Llull University)
www.url.cat

R&D&I and knowledge transfer

Barcelona Supercomputing Centre
www.bsc.cat

Barcelona Digital Foundation
www.bcndigital.org

Network of Science and Technology Parks in Catalonia (XPCAT)
www.xpcat.net

Local entities

22@Barcelona
www.22barcelona.com

Barcelona Energy Agency
www.barcelonaenergia.cat

Barcelona City Council
Area of Economy, Enterprise and Employment
www.bcn.cat/barcelonagrowth

Barcelona City Council – Environmental and Urban Services Area
www.bcn.cat/mediambient

Barcelona Activa
www.barcelonactiva.cat

Barcelona Metropolitan Region's Industrial Agreement
www.pacteind.org

b_TEC Foundation
www.btec.cat

LIVE Platform
www.livebarcelona.cat

Regional entities

ACC1Ó - Autonomous Region of Catalonia
www.acc10.cat

FECYT (Spanish Foundation for Science and Technology)
www.fecyt.es

FFA (Environmental Forum Foundation)
www.forumambiental.org

Research Support Institution Foundation of Catalonia
www.fundaciorecerca.cat

Catalan Energy Institute
www.icaen.net

IREC (Institute of Energy Research of Catalonia)
www.irec.cat

Spanish entities

CDTI (Centre for Industrial Technological Development)
www.cdti.es

CSIC (Higher Council for Scientific Research)
www.csic.es

Ministry of Education, Culture and Sport
www.educacion.gob.es

Ministry of Industry, Energy and Tourism
www.minetur.gob.es

Funding sources

ACC1Ó – Autonomous Regional Government
www.acc10.cat

Catalana d'Iniciatives
www.iniciatives.es

Catalan Institute of Finance
www.icfinances.com

Institute of Official Credit
www.ico.es

Avalis of Catalonia
www.avalis-srg.cat

ENISA (National Innovation Company)
www.enisa.es

Business entities

Barcelona Chamber of Commerce
www.cambrabcn.org

Spanish Association of Solar and Alternative Energy
www.asensa.org

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Una manera de fer Europa

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Government of Catalonia